



## Lessons from the Bay

# Bay and Pond Food Webs

## How does energy move through a food web in a pond and in the Chesapeake Bay?

### Objectives

Students will

- compare and contrast two water habitats
- research and classify plants and animals
- act out the Bay food web and diagram the flow of energy through it
- discuss the impact of pollution, loss of underwater grasses, and over-fishing on the Bay's animal resources
- identify and classify plants and animals found in a pond ecosystem and analyze data.

### Background

A food web shows the complex relationships between plants and animals: energy flows from producers (plants and algae that produce their own food) to consumers (organisms that eat plants or animals) to decomposers (organisms that digest the waste and dead bodies of plants and animals) and back to producers. Bay and pond food webs extend out of the water when land animals, including humans, eat food from the pond or the Bay. A key difference between the two environments is the fact that the Bay is a saltwater habitat while a pond contains fresh water. The plants and animals that live in each habitat are adapted to living in water with a certain level of salinity. The Chesapeake Bay may be a great distance from many schools in Virginia, but by studying its food web and then visiting a local pond, students will likely feel closer to the Bay.

### Procedures

#### Session 1 (at least 60 minutes)

Conduct this session in the classroom.

1. Read aloud *Crabbing in the Bay*. Discuss the importance of underwater grasses for crabs and the importance of crabs to Virginia's economy. Ask students why the pregnant crab was returned to the Bay. *What would happen if fishermen kept pregnant crabs?*

### Related Standards of Learning

Science:

3.1.a; 3.1.g; 3.1.j; 3.5.a; 3.5.b;  
3.5.c; 3.6.a; 3.10.a; 3.10.d; 4.1.a;  
4.1.b; 4.5.b; 4.5.c; 4.5.d; 4.8.b;  
5.1.e; 5.1.f

Mathematics:

3.21; 4.19; 4.20; 5.18

English:

3.1.c; 3.7.a; 3.7.b; 3.10.b; 4.1.b;  
4.5.d; 4.5.e; 4.6.b; 4.6.c; 4.7.c;  
4.8.a; 5.1.a; 5.6.f; 5.8.b; 6.5.a;  
6.5.d

### Time Required

3 sessions (times will vary)

### Materials

- Crabbing in the Bay (booklet follows this lesson plan, pages 135–144)
- books and other reference materials on Bay plants and animals (see Resources)
- hole-punchers
- Lily Pad Pond, by Bianca Lavies (see Resources)
- wildlife guidebooks (see Resources)
- birdsong CD and portable player (optional)
- 2 long-handled nets (optional)
- digital camera (optional)
- tape recorder (optional)
- plaster of Paris and a flexible plastic bucket to mix it in at the pond site (optional)

For each student:

- construction paper, drawing materials, and string
- graph paper
- chalk
- paper to record data
- clipboards (optional)

## Bay and Pond Food Webs

2. Tell students that the class is going to study the food webs of two water environments: the Chesapeake Bay and a pond. Ask students to state some similarities and differences between the two environments. Explain or review the concept of food webs. Tell students that to understand the relationships within a food web, one must learn about its plants and animals.

3. Assign a Bay organism to each student. Some important Bay organisms include:

- |                        |                  |
|------------------------|------------------|
| • algae                | • horseshoe crab |
| • bay anchovy          | • jellyfish      |
| • blue crab            | • osprey         |
| • bluefish             | • oyster         |
| • bristle worm         | • redhead grass  |
| • Canada goose         | • shad           |
| • canvasback duck      | • shrimp         |
| • clam                 | • sponge         |
| • diamondback terrapin | • starfish       |
| • dragonfly            | • striped bass   |
| • eel                  | • widgeon grass  |
| • eelgrass             | • wild celery.   |
| • great blue heron     |                  |

Be sure to assign some of the grasses; otherwise, there will be a significant omission from the food web.

4. Direct students to research their organisms. (See “Using the Library Media Center for Project Research” and “Using the World Wide Web for Project Research” on pages 55–58 of the **Project Action Guide**.) Provide books, fact sheets, and Web site URLs (see Resources). Tell each student to find a picture of the assigned organism, one or two interesting facts about the organism, and its energy source. An animal’s energy source is that which it eats.
5. When students have gathered enough information, provide them with construction paper, drawing materials, and string. Instruct students to draw a picture of their organism and to write on it the energy source and facts gained from their research. They should then attach the string to the drawing so that it may be worn around the neck.

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### Session 2 (45 minutes)

*Conduct this session in the schoolyard.*

1. Gather students on a paved surface and have them wear their drawings from Session 1. Discuss the meanings of *producer*, *consumer*, and *decomposer* as they relate to organisms in a food web. Designate an area for each type, and

direct students to classify their organisms as producer, consumer, or decomposer by moving to the designated area. Share the results by naming the organisms in each group.

2. Next, discuss the meanings of *herbivore*, *carnivore*, and *omnivore*. Direct the consumers to sort themselves into these smaller groups. Share the results by naming the organisms in each group.
3. Next, the class will illustrate the Bay food web. Give a piece of chalk to each student, and have the class spread out across the pavement. Draw a circle representing the sun. Tell students to circle the spot where they are standing and to write the name of their organism in the circle. Next, direct students to find the circles representing organisms that their own organism can eat. If a student cannot find what his or her organism eats, the student may draw a new circle to represent that organism and draw an arrow back to his or her own circle. (Plants will draw an arrow from the circle representing the sun.)
4. When students have finished illustrating the food web, have them return to their circles and find the organisms that eat theirs.
5. Draw a circle to represent a human. Ask for a show of hands to indicate which students think their organism might be eaten by a human; then draw arrows to connect those circles to the human circle.
6. Discuss the complexity of the Bay food web. Ask students what they think is happening to the web as a result of pollution, loss of underwater grasses, and over-fishing.

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### Session 3 (times will vary)

*Conduct this session at a local pond.*

1. Choose a local pond, perhaps at a local or state park, and take the class there on a field trip.
2. Find a spot for the class to sit where they can see the pond without being too close. Read aloud *Lily Pad Pond* by Bianca Lavies (see Resources). Discuss the part of the pond food web described in the book. Note the plants and animals mentioned in the text and those that can be seen in the pictures.
3. Explain that a pond habitat and its food web include the water in the pond and the land and air that surround it because there is interaction between plants and animals in and out of the

pond. An established natural pond environment will have many plants growing around the edges and in the water and will probably have great biodiversity and a complex food web. If the environment is carefully manicured and has few plants, it will not support many animals, resulting in little biodiversity and a smaller food web.

4. Ask students, observing the pond from a distance, to make predictions about the pond's biodiversity. Have them describe the general pond habitat and write their predictions.
5. Assign students to groups, and direct each group to look for one of the following:
  - amphibians and reptiles
  - birds
  - fish
  - land insects
  - mammals
  - trees
  - water insects and macroinvertebrates
  - water plants
  - wildflowers.

Remind students that these organisms may be found in or out of the water. Point out that in the absence of an actual sighting, there are other signs that can be used to identify animals, including footprints and birdcalls. Other indications of animals may include anthills, insect sounds, molted insect exoskeletons, trees gnawed by beavers, bird nests, skeletons, or empty shells from turtles or shellfish.

6. Provide each group with the appropriate wildlife guidebooks and resources for the assigned organism type. You might include a reference for identifying footprints and other evidence of animal activity. For the group searching for birds, a birdcall identification CD in a portable player would be helpful. Long-handled nets may be necessary for those groups who will collect samples of water insects and fish.
7. Review safety procedures: remind students that they should not touch wild animals or broken glass. Consider providing rubber gloves for students who are handling pond nets. Discuss the effects of noise level on wildlife, and encourage students to work quietly.
8. Finally, before students begin to observe the pond, instruct them to take notes (on clipboards, if available) on the types and approximate numbers of each plant or animal they identify.

They should also note whether they saw the actual organism or evidence of it. (Additional ways to record data include taking photos with a digital camera, using a tape recorder to record birdsongs and insect sounds, and making plaster casts of footprints.)

*Return to the classroom.*

9. Upon returning to the classroom, share the data with the class, and give a total count for types of organisms they identified. Instruct students to graph this data and draw conclusions about other organisms that are likely to have been in the pond environment but were not observed. (See "Preparing Graphs and Charts" on page 69 of the **Project Action Guide**.) Discuss the level of biodiversity and the complexity of the food web in the pond. Have students organize and summarize their conclusions in a written paragraph.

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## Resources

Amos, William H. *Life in Ponds and Streams*. Books for Young Explorers. Washington: National Geographic Society, 1981. ISBN 0870444042.

Bell, C. Ritchie, and Anne H. Lindsey. *Fall Color Finder: A Pocket Guide to the More Colorful Trees of Eastern North America*. Chapel Hill: Laurel Hill Press, 1991. ISBN 0960868828. (See <<http://www.laurelhillpress.com>>.)

Burrell, C. Colston, ed. *Ferns: Wild Things Make a Comeback in the Garden*. Brooklyn: Brooklyn Botanic Garden, 1994. ISBN 0945352824. (See <<http://www.bbg.org>>.)

Burt, William H., and Richard P. Grossenheider. *A Field Guide to Mammals: North America north of Mexico*. Peterson Field Guides. 3rd ed. Boston: Houghton Mifflin, 1998. (See <<http://www.houghtonmifflinbooks.com/peterson/mammal.cfm>>.)

Burton, Robert and Stephen W. Kress. *The Audubon Backyard Bird Watcher: Birdfeeders and Bird Gardens*. San Diego: Thunder Bay, 1999. ISBN 1571451862. (See <<http://www.thunderbaybooks.com>>.)

"Chesapeake Bay: Introduction to an Ecosystem." Report. Chesapeake Bay Program. <<http://www.chesapeakebay.net/pubs/ecosystem.pdf>>.

## Bay and Pond Food Webs

- “Chesapeake Bay Life in the Shallows.” Brochure. Chesapeake Bay Program. (At <http://www.chesapeakebay.net/search/pubs.htm>), click on “Chesapeake Bay Life in the Shallows” to order.)
- Chesapeake Bay Foundation Guide to Underwater Grasses*. Flash Guide. Chesapeake Bay Foundation. [http://www.cbf.org/site/DocServer/Guide\\_to\\_Underwater\\_Grasses.pdf?docID=116](http://www.cbf.org/site/DocServer/Guide_to_Underwater_Grasses.pdf?docID=116).
- Dorros, Arthur. *Animal Tracks*. New York: Scholastic, 1991. ISBN 0590433660. <http://www.arthurdorros.com/books/animaltracks.html>.
- Durrell, Gerald, and Lee Durrell. *A Practical Guide for the Amateur Naturalist*. New York: Knopf, 1989. ISBN 0679728376.
- Edlin, Herbert L. *The Tree Key: A Guide to Identification in Garden, Field, and Forest*. London: Frederick Wayne, 1979. ISBN 0723220352.
- Fleming, Denise. *In the Small, Small Pond*. New York: Holt, 1993. ISBN 0805022643.
- Gibbons, Gail. *Frogs*. New York: Holiday House, 1993. ISBN 082310528.
- Hirschi, Ron, and Dwight Kuhn. *Turtle’s Day*. New York: Cobblehill Books, 1994. ISBN 0525651721.
- Kellogg, Loren Larken. *Monitor’s Guide to Aquatic Macroinvertebrates*. Save Our Streams. 2nd ed. Isaak Walton League of America, 1994. (See <http://www.iwla.org/merchant2/merchant.mv>.)
- Korman, Susan, and Stephen Marchesi. *Box Turtle at Silver Pond Lane*. Norwalk: Soundprints, 2001. ISBN 1568998600.
- Lavies, Bianca. *Lily Pad Pond*. New York: E.P. Dutton, 1989. ISBN 0525444831.
- Lipson, Jane A., and Robert L. Lipson. *Life in the Chesapeake Bay: An Illustrated Guide to the Fishes, Invertebrates, Plants, Birds, and other Animals of Bays and Inlets from Cape Cod to Cape Hatteras*. 2nd ed. Baltimore: The Johns Hopkins U P, 1997. ISBN 080185475X. <http://www.press.jhu.edu/press/index.html>.
- “Little Limnologist,” “Pond Scum,” and “Whose Clues?” *Let’s Explore and Research Nature (LEARN)*. (Environmental education lesson plans for field trips to Lake Anna State Park. Contact Lake Anna State Park: 540-854-5503.)
- Mahnken, Jan, and Jeffrey C. Domm. *The Backyard Bird-Lover’s Guide: Attracting, Nesting, Feeding*. North Adams: Storey, 1996. ISBN 0882669273. (See <http://www.storeybooks.com>.)
- McGovern, Ann, ed. *Arrow Book of Poetry*. New York: Scholastic, 1965. (Includes Rose Fyleman’s “Regent’s Park,” p. 47, about a duck in a pond.) ISBN 0590336711.
- Miller, Dorcas S., and Ellen Amendolara. *Winter Weed Finder: A Guide to Dry Plants in Winter*. Rochester: Nature Study Guild, 1989. ISBN 0912559171. (See <http://www.naturestudy.com>.)
- Miller, Ruth, and Martine Gourbault. *I Went to the Bay*. Buffalo: Kids Can, 1999. ISBN 1550744984.
- Milne, Lorus, and Margery Milne. *National Audubon Society Field Guide to North American Insects and Spiders*. New York: Knopf, 1998. ISBN 03940507630.
- Mitchell, Robert T., and Herbert S. Zim. *Butterflies and Moths: A Guide to the More Common American Species*. Golden Guide. Racine: Western, 1977. ISBN 030724413X.
- Opler, Paul A., and Vichai Malikul. *Eastern Butterflies*. Peterson Field Guides. 1992. Boston: Houghton Mifflin, 1998. ISBN 0395904536. (See <http://www.houghtonmifflinbooks.com/peterson/fieldguides.cfm>.)

Peterson, Roger Tory, and Virginia Marie Peterson. *A Field Guide to the Birds of Eastern and Central North America*. 5th ed. Peterson Field Guides. Boston: Houghton Mifflin, 2002. ISBN 0395740479. (See <<http://www.houghtonmifflinbooks.com/peterson/fieldguides.cfm>>.)

Peterson, Roger Tory. *Roadside Wildflowers*. Peterson FlashGuides. Boston: Houghton Mifflin, 1997. ISBN 039582995X. (See <<http://www.houghtonmifflinbooks.com/peterson/petersonhome.cfm>>.)

Phillips, Roger. *Trees of North America and Europe: A Photographic Guide to More than 500 Trees*. 1978. New York: Random House, 1993. ISBN 0394735412.

“Preparing Graphs and Charts.” Project Action Guide. *Lessons from the Bay*. 69–70.

Reid, George Kell, et al. *Pond Life: A Guide to Common Plants and Animals of North American Ponds and Lakes*. Golden Guide. 1967. New York: St. Martin’s, 2001. ISBN 1582381305.

Silver, Donald M., Patricia J. Wynne, and Dianne Ettl. *Backyard*. One Small Square. New York: McGraw-Hill, 1997. ISBN 007057930X.

Tate, Suzanne. *Crabby’s Water Wish: A Tale of Saving Sea Life*. Nags Head: Nags Head Art, 1991. ISBN 1878405047.

United States. Dept. of the Interior. U.S. Fish and Wildlife Service. Chesapeake Bay fish and wildlife fact sheets. (Contact Chesapeake Bay Estuary Service: phone 310-224-2732.)

“Using the Library Media Center for Project Research.” Project Action Guide. *Lessons from the Bay*. 55–56.

“Using the World Wide Web for Project Research.” Project Action Guide. *Lessons from the Bay*. 57–58.

Van Dusen, Barry W., Betsy Colburn, and Chris Leahy, ed. *Pond Watchers Guide to Ponds and Vernal Pools of Eastern North America*. Lincoln: Massachusetts Audubon Society, 1995. ISBN 0932691145.

Virginia. Dept. of Forestry. *Forest Trees of Virginia*. Booklet. (See <<http://www.dof.state.va.us>>.)

Voshell, J. Reese, Jr. *A Guide to Common Freshwater Invertebrates of North America*. Blacksburg: McDonald and Woodward, 2002. ISBN 0939923874.

Watts, May T. *Tree Finder: A Manual for the Identification of Trees by Their Leaves*. Rochester: Nature Study Guild, 1991. ISBN 0912550015.

### Classroom Assessment Suggestions

- Research on Bay plants and animals including energy sources and description of the organism
- Recording of pond organism data
- Graph of pond organisms and conclusion paragraph

### Extensions for Students

- Cut out the pictures of Bay animals and plants drawn in Session 1, and create a bulletin board that illustrates the Bay food web.
- Organize all the data collected at the pond, and display it with students’ graphs.
- Make a chart comparing similarities and differences between Bay and pond food webs or Bay and pond organisms. (See “Preparing Graphs and Charts” on page 69 of the **Project Action Guide**.)
- Take a field trip to Lake Anna State Park or another state park to learn more about animal footprints and pond ecosystems, as in the activities “Whose Clues,” “Little Limnologist,” and “Pond Scum” (see Resources).

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## ***Crabbing in the Bay***

### **Assembly Instructions**

1. Print the booklet on back-to-back pages. (If your printer will not print back-to-back, you can tape page 2 to the back of page 1, page 4 to the back of page 3, etc.)
2. Fold the pages down the middle and staple together along the fold.